



Allen-Bradley

160-IB1 InterBus Communication Module

Catalog Number: 160-IB1

Firmware: 1.00

User Manual

**Rockwell
Automation**

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. “*Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls*” (Publication SGI-1.1) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual we use notes to make you aware of safety considerations.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Attentions help you:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is especially important for successful application and understanding of the product.



Shock Hazard labels may be located on or inside the drive to alert people that dangerous voltage may be present.

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Using This Manual

The purpose of this manual is to provide you with the necessary information to apply the Bulletin 160-IB1 Communications Module. Described in this manual are methods for installing, configuring, and troubleshooting the 160-IB1 InterBus Communications Module.

For information on specific drive features, refer to the 160 SSC™ Variable Speed Drive (Series C) *User Manual*.

Important: Read this manual in its entirety before installing, operating, servicing, or initializing the IB1 Module.

Who Should Use This Manual?

This manual is intended for qualified personnel. To make efficient use of the Communication Module, you must be able to program and operate InterBus communications devices, as well as have an understanding of the parameter settings and functions of the 160 Drive.

Conventions

In this manual we refer to the:

- 160-IB1 Communication Module as Communication Module, IB1 Module or Module.
- 160 SSC Adjustable Frequency AC Drive as the 160 Drive or drive.

In addition, parameter numbers and names (both 160 Drive and IB1 Module) are shown in bold typeface and follow the format PXX - [*] where P denotes parameter, XX denotes the two digit parameter number, and * represents the parameter name. For example, **P01 - [Output Frequency]**.

IB1 Compatibility

The IB1 Module is compatible only with 160 Drives Series C or above. When properly connected, the module communicates via an InterBus network.

Reference Manuals

The following documents contain additional information concerning Allen-Bradley products. To obtain a copy, contact your local Allen-Bradley Sales Office or visit the “On-Line Publications” area of the Allen-Bradley Internet home page at: [www.ab.com.manuals](http://www.ab.com/manuals)

For	Read This Document	Publication Number
Additional information about networking and the SLC™ 500	SLC 500 Modular Hardware Style Manual	1747-6.2
Information about the AIC+	AIC+ Advanced Interface Converter User Manual	1761-6.4
Instruction set information for the SLC 500 and MicroLogix™ 1000	SLC 500 and MicroLogix 1000 Instruction Set Reference Manual	1747-6.15
For general MicroLogix 1000 information	MicroLogix 1000 User Manual	1761-6.3
For 160 SSC Drive Information	160 SSC™ Variable Speed Drive (Series C) User Manual	0160-5.17ML
A complete listing of current Allen-Bradley documentation, including ordering instructions. Also indicates whether the documents are available on CD-ROM or in multi-languages.	Allen-Bradley Publication Index	SD499
A glossary of industrial automation terms and abbreviations	Allen-Bradley Industrial Automation Glossary	AG-7.1
Information about the SSC-IBS-SLC™ Scanner	Scanner Card User Manual. SST Woodhead documentation can be obtained online at http://www.mySST.com/download/	Version 1.0

Safety Precautions



ATTENTION: Only personnel familiar with 160 Drives, Communication Modules and associated machinery should plan or implement the installation, start-up, configuration and subsequent maintenance of this module. Failure to comply may result in personal injury and/or equipment damage.



ATTENTION: This module contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing, or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference Allen-Bradley Publication 8000-4.5.2, *Guarding Against Electrostatic Damage* or any other applicable ESD protection handbook.



ATTENTION: The drive contains high voltage capacitors which take time to discharge after removal of AC line power. Before installing or removing the Communication Module, ensure isolation of mains supply from line inputs R, S, T (L1, L2, L3). Wait the recommended amount of time for the capacitors to discharge to safe voltage levels (refer to the 160 SSC™ Variable Speed Drive (Series C) *User Manual* for recommended time). Failure to do so may result in personal injury or death.



ATTENTION: When a system is configured for the first time, the motor must be disconnected from the machine or process during initial system testing. Hazard of injury or equipment damage may occur due to unintended or incorrect machine motion.

Product Overview

This chapter contains the following information:

- The physical layout of the module.
- Overview and components.

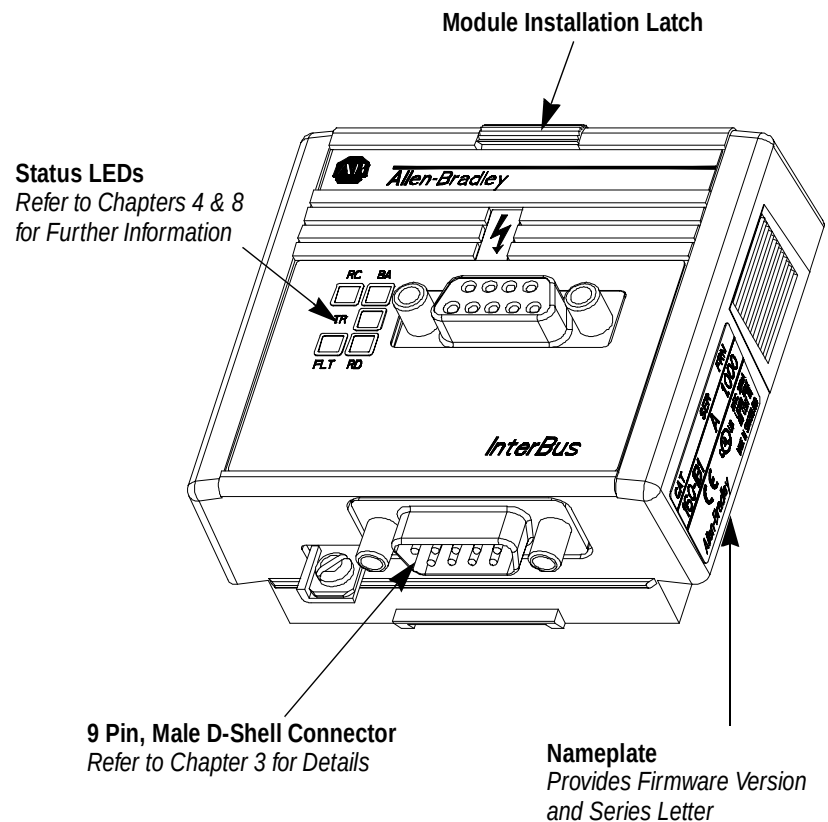
Module Description

The IB1 Module is an optional interface device designed to provide a direct, digital link between an InterBus Master and the 160 Drive. The module connects to the drive through the expansion/keypad port on the front of the drive. Refer to the Figure 1.1 for general layout of the module and Chapters 4 or 8 for details on the LED indicators.

The IB1 Module has the following characteristics:

- 3 word process data channel (control, reference & diagnostics)
- 1 InterBus PCP telegram for configuration and reading of drive parameters and error codes
- DRIVECOM 20 (part of 21) profile support.

Figure 1.1
Module Front View



End of Chapter 1

Quick Start for Experienced Users

This chapter can help you start using the IB1 Communication Module. If you have installed or configured a network previously and are familiar with Allen-Bradley communication modules and drives, this information can help reduce the time of installation. If you are uncertain, use the full installation/configuration information beginning in Chapter 3.

We base the procedures here on the assumption that you understand the basic concepts, know how to program the 160 Drive and understand electronic process control.

Because it is a *start-up guide for experienced users*, this chapter *does not* contain detailed explanations about the procedures listed. It does, however, reference other chapters in this book where you can find more information.

If you have any questions or are unfamiliar with the terms used or concepts presented in the procedural steps, *always read the referenced chapters* and other recommended documentation before trying to apply the information.

This chapter contains the following information:

- What tools and equipment you need.
- How to install and wire the Communication Module.
- System power-up procedures.

Required Tools and Equipment

Have the following tools and equipment ready:

- 3.2 mm (1/8 in.) flat blade screwdriver.

Procedures

Step	Action	For Further Information Refer to...
1.	Review Attention statements in the Preface.	
2.	Ensure that power to the 160 Drive has been removed.	160 Drive User Manual
3.	Verify that the 160 Drive is correctly installed and wired. Stop Input (TB3-7, TB3-8) must be jumpered together to start drive.	160 Drive User Manual
4.	Configure the 160 Drive for the IB1 Module so the drive can accept control logic and speed reference via the network. *	Chapter 5 (Parameters)
	Set P46 - [Input Mode] to a value of "2" or "6" as described in Table 6.A. This will configure the drive to accept the logic commands from the network. Note: If the value has to be changed, set P56 - [Reset Functions] to "2" or reboot the drive.	
	Set P59 - [Frequency Select] to "1." This will configure the drive to accept speed commands from the network. Set P66 - [RPM Scaling] for the RPM/Hz Scaling factor. This allows the Network Reference to be in RPM.	
5.	Remove Program Keypad Module or Ready/Fault Indicating Panel from the drive.*	Chapter 3 (Installation)
6.	Install the IB1 Module.	Chapter 3 (Installation)
7.	Connect communication cable.	Chapter 3 (Installation)
8.	Power up the drive and the network.	Chapter 3 (Installation)
9.	Check for proper operation.	

* Parameter setting might also be done via the Keypad Module prior to removal

Installation and Wiring

This chapter contains information needed to:

- Check for rotational direction to comply with DRIVECOM 20.
- Meet the requirements of the EMC and LowVoltage directives for CE compliance.
- Remove a pre-installed Program Keypad Module or Ready/Fault Indicating Panel.
- Install the IB1 Module.
- Wire the communication cables.
- Wire the protection earth connection
- Remove the IB1 Module from the drive.

Read this chapter completely before you attempt to install or configure your module. Before applying power, review the Attention statements presented throughout this manual. Verify that all connections are secure and that all selections are correct.

DRIVECOM 20 Compliance

In order to comply with DRIVECOM 20 forward rotational direction is defined as *turning clockwise facing motor shaft* with *positive* speed reference applied. Refer to the 160 SSC™ (Series C) Variable Speed Drive User Manual, Start-up procedure, chapter 4.



ATTENTION: Unpredictable operation may occur if you fail to check connections for compatibility with your application. Unpredictable operation may result in personal injury, death, and equipment damage.

EMC Directive 89/336/EEC Compliance

This product complies with Electromagnetic Compatibility (EMC) Directive 89/336/EEC when conforming with the following installation requirements:

- The essential requirements for a conforming EMC installation for the Bulletin 160 SSC are employed. Refer to the 160 SSC™ Variable Speed Drive (Series C) *User Manual*.

Low Voltage Directive 73/23/EEC Compliance

This product complies with Low Voltage Directive 73/23/EEC when conforming with the following installation requirements:

- The essential requirements for a conforming LowVoltage Directive installation for the Bulletin 160 SSC are employed. Refer to the 160 SSC™ Variable Speed Drive *User Manual*.
- Review the Attention statements in the Preface, and other areas throughout this manual prior to installation of the module.

Module Installation/Removal



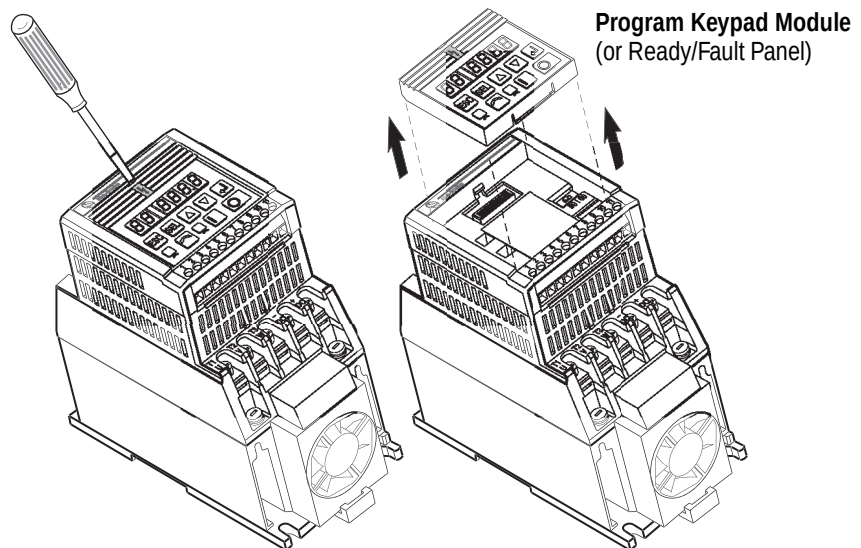
ATTENTION: The drive contains high voltage capacitors which take time to discharge after removal of mains supply. Before installing or removing a keypad/module, ensure isolation of mains supply from line inputs R, S, T (L1, L2, L3). Wait the recommended amount of time for the capacitors to discharge to safe voltage levels (refer to the 160 SSC™ Variable Speed Drive (Series C) *User Manual* for recommended time). Failure to do so may result in personal injury or death.

Keypad or Ready/Fault Panel Removal

Before installing the IB1 Module, it may be necessary to remove a previously installed Program Keypad Module or Ready/Fault panel.

1. Verify that all power to the drive is removed.
2. Insert a small screwdriver into slot, pry back and pivot module out. Avoid bending or twisting the contact pins located under the module.

Figure 3.1
Removing Program Keypad Module

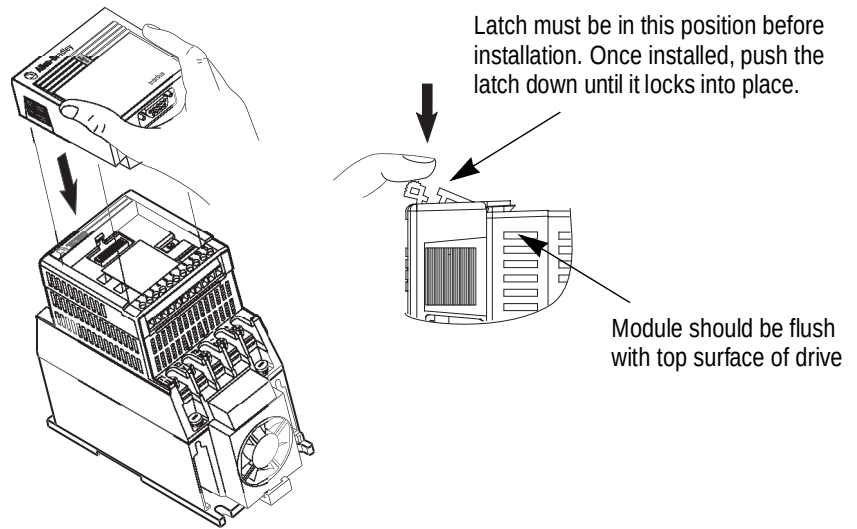


Installing the IB1 Module

Install the IB1 Module in the drive by following these steps:

1. Verify that all power to the drive is removed.
2. Verify that the latch is up (see Figure 3.2). Insert the module, ensuring that the pins on the back of the module line up with the drive connector/expansion port.
3. Press the module down until it is fully seated (sides are flush with the top surface of the drive).
4. Press the latch down until it snaps into place.

Figure 3.2
Communication Module Installation

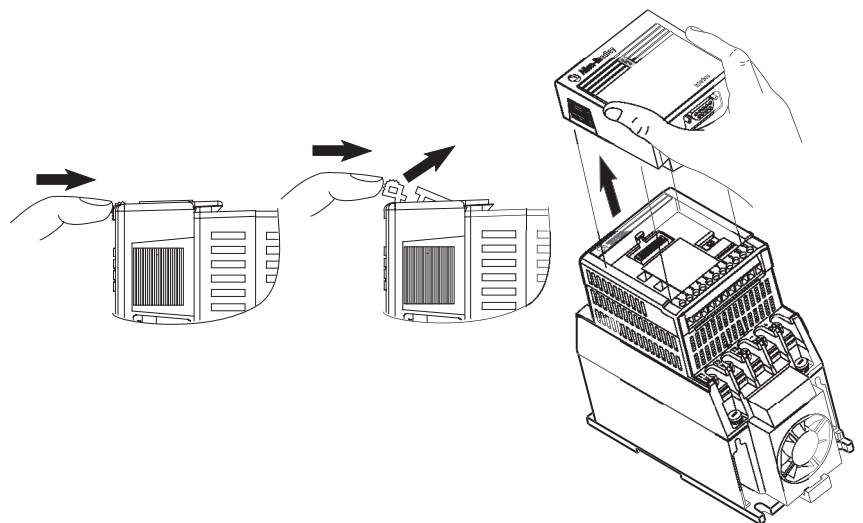


Removing the IB1 Module

If you need to remove the module from the drive, you must

1. Verify that all power to the drive is removed. Review Attention statement on page 3-2.
2. Disconnect the cable/connector from the module (if present).
3. Press in on the module's latch and then push away and up.
4. Grasp the module and pull straight up. Avoid bending or twisting the contact pins located underneath the center portion of the module.

Figure 3.3
Removing the Communication Module



Wiring the Drive Terminal Block

The 160 drive and 160-IB1 interface can be controlled on a network in 2 different modes.

[Input Mode] = 2

This mode is used where the drive is controlled solely by the network. The 160-SSC drive requires, that a stop signal is present on the hardware terminals, before the drive can be started.

Control Terminal Block 3 (TB-3) pins 7 & 8 need to be linked by either a wire bridge or a normally closed stopping device.

Fitting a stopping device (e.g. pushbutton) in place of the link, can provide additional local stop/emergency stop capability.

Important: Failure to link the stop command input, will result in the drive generating a fault, and inability to run across a network.

[Input Mode] = 6

This mode is used whereby it is possible to control the drive across the network or locally, by putting a switch on the Control Terminal Block 3 (TB-3) pins 7 & 8.

When the switch is closed, the Frequency source comes from the reference as defined by **P59 - [Frequency Select]**. As we are using the 160-IB1, the reference is across the Interbus network.

Additionally the start command is active across the network.

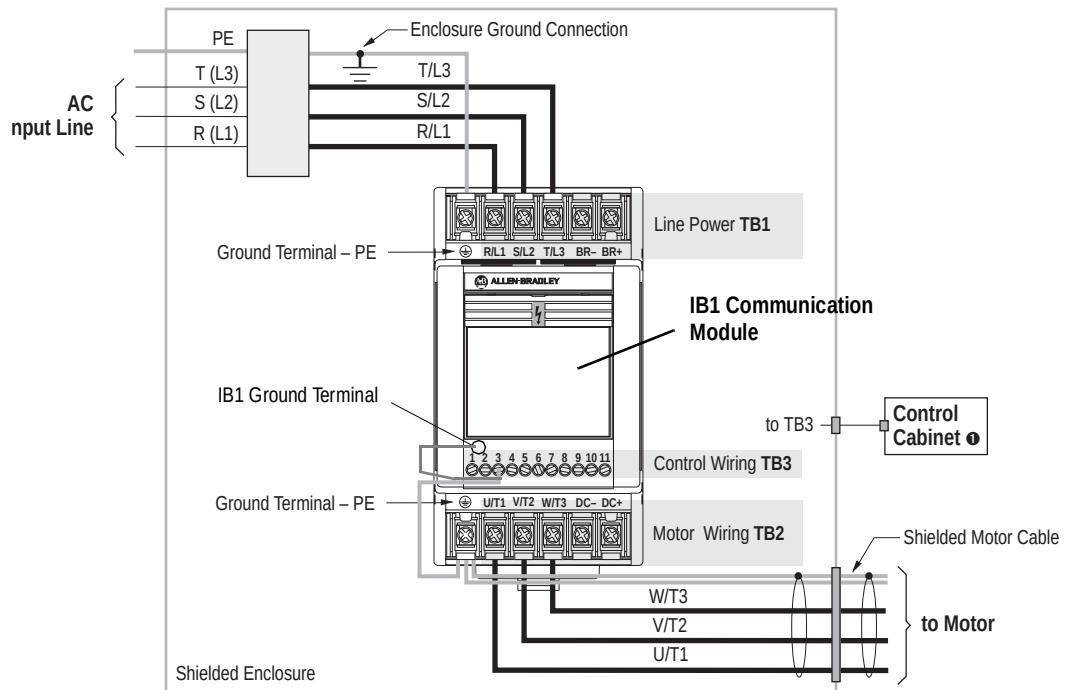
When the switch is open, the Frequency source comes from the terminal block (analogue reference or potmeter), regardless of the setting of f P59 - [Frequency Select]. Additionally the start command is controlled by the terminal block or keypad.

Wiring the IB1 Ground Terminal

In addition to the ground connections shown in Appendix C of the 160 SSC manual, the ground terminal at the bottom of the IB1 module must be solidly connected (and as short as possible) to the signal common terminal 3 at TB3 of the 160 SSC drive, as shown in Figure 3.4:

This connection shall have a cross section of 1.5 mm^2 .

Figure 3.4
IB1 Module Grounding



■ = EMC Tested Shielded Cable Clamp (or Metal Conduit)

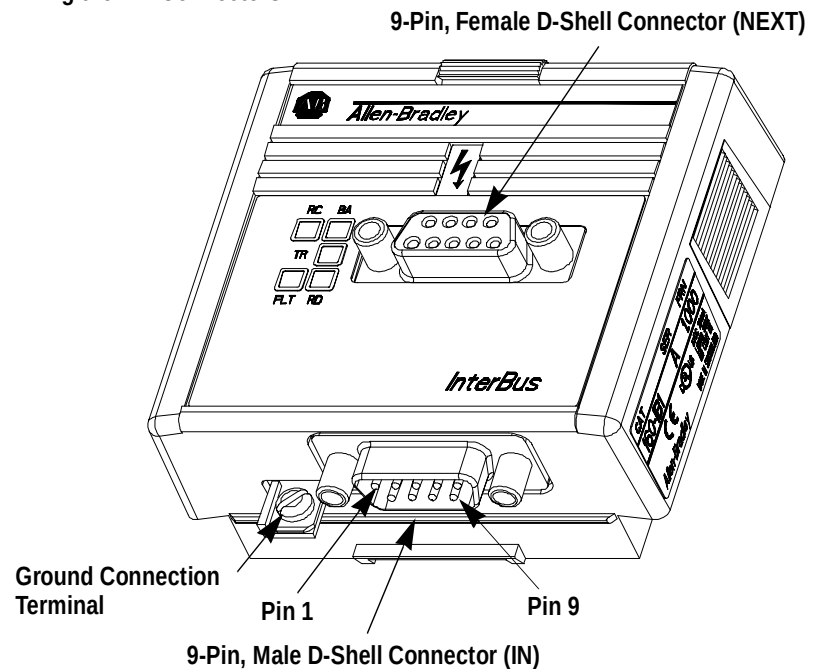
❶ When the control circuitry is located outside of the 160 enclosure.

Wiring the Connectors

The example in Figure 3.7 can be used as a guide when wiring.

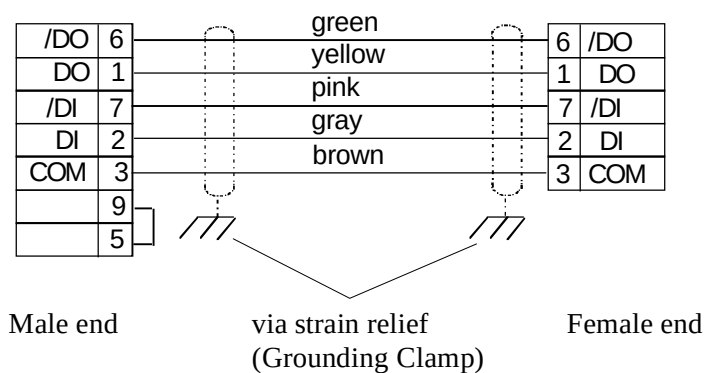
Important: Keep communication wiring away from high noise sources such as motor cables.

Figure 3.5
Wiring the IB1 Connectors



Note: For better visibility of the status LED's it is recommended to use a cable inline with connector (180° not 90°).

Figure 3.6
Remote Bus Cable Termination



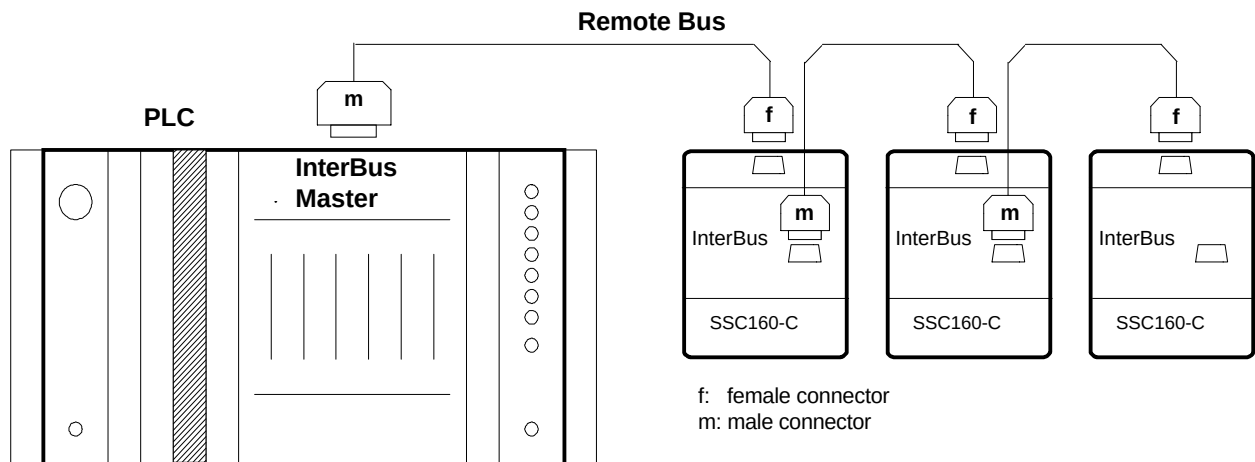
Note: Wire colors may vary depending on cable manufacturer

Connecting the Communication Cable to the Module

Follow these steps to connect your module.

1. Verify that the cable/connector is correctly wired (See Figure 3.6).
2. Locate the D-shell (IN) connector at the base of the IB1 Module.
3. Plug cable/connector into the IB1 D-shell connector and secure.
4. Extend the network via the D-shell (NEXT) connector on the front.
5. Last IB1 of network, D-shell (NEXT) connector must be left empty for the network to be correctly terminated.

Figure 3.7
Remote Bus Connection



End of Chapter 3

Modes of Operation

Chapter 4 contains the following information:

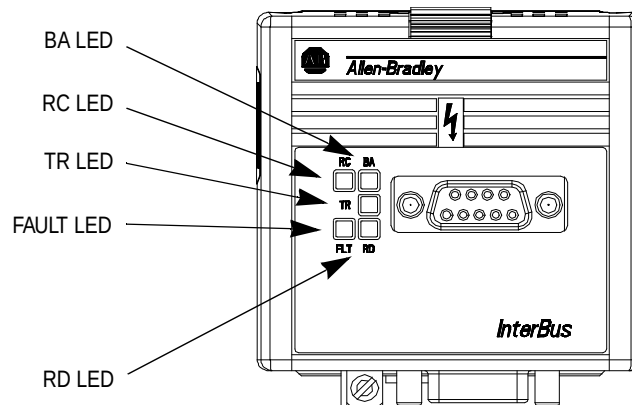
- Powering up the drive with the IB1 Module installed.
- The modes of operation and LED indications.

Powering Up the Drive

After you have installed the IB1 Module, apply power to the drive and to the connected device. The READY LED should illuminate. If it does not, refer to Chapter 8, *Troubleshooting*.

LED Indicators

The IB1 Module has five LEDs (see figure below) which provide module status.



The LEDs are defined as follows:

- **Four Communication Status LEDs** – These LEDs have the following functions:
 - RC (yellow):** Remote bus Check (Input cable connection o.k.)
 - BA (green):** Bus Active
 - TR (green):** Transmit/Receive (PCP Communication active)
 - RD (red):** Remote bus Disable (Output cable connection missing)
- **FLT (red)** – This LED tracks the fault status of the 160 Drive. When no faults are present, the LED will be off. The LED will illuminate (red) if a drive fault occurs.

For more information refer to Table 8.A.

Operation Modes

The IB1 Module has three modes of operation.

- Power-up mode
- Run mode
- Error mode

Power-up Mode

If the power-up sequence is successful, the module enters the run mode (RC LED on) and the TR LED flashes green.

If the power-up sequence fails, the TR LED will go to off and the module will enter the Error Mode (see below).

Run Mode

After a successful power-up, the IB1 Module enters the run mode and operates as a slave device to a master device (BA LED on).

The RC LED is on, indicating the receiving of messages.

In run mode, the module:

- Accepts and responds to messages from the master on the network.
- Monitors cable integrity and transmission performance.

TR LED is on in case of PCP messages are exchanged. If an error is detected, the module enters Error Mode (see below).

Error Mode

If the module detects an error, the fault is indicated by the FLT LED. Refer to Chapter 8 for details on how to recover from an error.

InterBus Parameter Descriptions and Data Protocol

This chapter provides a listing and description of the Bulletin 160 Drive parameters related to Network Operation, and the IB1 Module Data Protocol information.

Important: Refer to your 160 SSC™ Variable Speed Drive (Series C) *User Manual* for drive parameter descriptions.

160 SSC Drive Parameters

Parameter Number		Access	[Parameter Name] and Description	Min./Max. Values	Default
Drive	IB1 Index; Subindex				
46	0x5FF0; 46 0x5FF9; 46	Read Write	[Input Mode] Configures the TB3 control inputs for various 3-wire or 2-wire control schemes. Also enables/disables the program keypad module input control. <i>Settings:</i> must be set to either 2 = Program Keypad Module control or 6 = 2-wire TB3 Control/Keypad or Communication control A contact closure on TB3 terminals 7 and 8 is required for the drive to respond to a Run command. Important: This parameter cannot be programmed while the drive is running. In addition, power must be cycled or P56 - [Reset Function] must be set to 2 for the change to take effect.	0/9	0
59	0x5FF0; 59 0x5FF9; 59	Read Write	[Frequency Select] Selects the source of the frequency command for the drive. The reference to P58 - [Internal Frequency] is bipolar, so a positive reference gives forward rotation, and a negative reference gives reverse direction. <i>Settings:</i> must be set to 1 = internal freq. command from P58 - [Internal Frequency] .	0/1	0
66	0x5FF0; 66 0x5FF9; 66	Read Write	[RPM Scaling] A scaling factor is required to interpret a speed reference in RPM at the [Maximum Frequency] of the drive. The 160 Drive parameter P66 - [Preset Frequency 5] is used by the IB1 Module for this purpose. $P66 = rRPM / rf$ rf: required motor frequency to achieve rRPM rRPM: final RPM at application output (e.g. speed at gear box output), which will be displayed at InterBus Master. Application Speed [rpm] = Drive Output Frequency x P66 [RPM Scaling] e.g. 1500 rpm = 50 Hz x 30 (4 pole motor) P66 = 30.0 (300) Gear Box 1:20: 75 rpm = 50 Hz x 1.5 (4 pole motor) P66 = 1.5 (15) For network operation the P66 values in brackets are valid, which are ten times the values for keypad operation. If P66 - [RPM Scaling] is set to 0, speed reference may be sent via the network directly in 1/10 of Hz. e.g. SpeedRef [Hz] (InterBus) = 405 results in 40.5 Hz of output frequency. Speed feedback is considered to be P01 - [Output Frequency] , which reflects the output frequency considering ramp rates.  ATTENTION: Unpredictable motor speed can cause death, injury or equipment damage. Do not use P66 as the [Preset Frequency 5] function via control terminal wiring.	0-240 [0-2400]	50

Note:

P57 [Program lock] may be set to 1 (locked), but parameter programming via network will still be possible.

InterBus Data Protocol

Data Channels

The data transfer in Interbus terminology is called **Peripherals Communications Protocol (PCP)**.

Process data and parameter data is transmitted in the InterBus system via two independant transmission channels. i.e. the process data channel and the parameter data channel.

The **process data channel** cyclically transmits process data in the form of an I/O image. This image contains the logic control word to start /stop the drive, and the reference to control the speed, which is used in the application program to control the drive. Additionally this image receives the drive status word, and the speed feedback word, which is used in the application program to monitor drive operation. Together with a diagnostics register, this results in three registers being transmitted to and from the drive (see table 5 A & B). This direct memory access to control the drive is both simple and quick.

The **parameter data channel** only transmits data if necessary, and is integrated into the transmission protocol being handled by the InterBus master. When the parameter data channel is used, the master inserts a frame of information to send to the drive requesting different actions (see table 5E). This frame of information requests a read or write parameter/attribute which can take several physical cycles of read/write with handshaking to implement, resulting in much slower access than the process data channel.

Thus the combination of the faster process data channel for control, and the slower parameter data channel, optimises the data transmission.

Data from InterBus Master to IB1 Slave

A scaling factor is required to interpret a speed reference in RPM. The 160 Drive parameter **P66 - [Preset Frequency 5]** is used by the IB1 Module for this purpose. See “160 SSC Drive Parameters” on page1.



ATTENTION: Unpredictable motor speed can cause death, injury or equipment damage. Do not use P66 as the **[Preset Frequency 5]** function via control terminal wiring.

Table 5.A

Register No.	Register (Words)	Description
0	Control Word	According to DRIVECOM 20
1	Speed Reference	Speed reference in RPM
2	Diagnostics	reserved

Data from IB1 Slave to InterBus Master

Speed Feedback, displayed by Register 1, is scaled in RPM according to **P66 - [RPM Scaling]**.

Table 5.B

Register No.	Register (Words)	Description
0	Status Word	According to DRIVECOM 20
1	Speed Feedback	160 Drive Output Frequency (motor RPM)
2	Diagnostics	reserved

Control and Status Word DRIVECOM 20/21

Control and Status word bits are defined as follows (speed control):

Table 5.C

Control Word (Bit definition)

Bit No.	DRIVECOM 20 Control	SSC160
0	Switch-on	1 = Switch-on
1	Disable voltage	0 = Disable
2	Fast Stop	0 = Stop
3	Enable Operation	1 = Enabled
4	reserved	
5	reserved	
6	reserved	
7	Reset Fault	0 to 1 Transition = Reset
8 to 15	reserved	

To **start** the drive, set the control word (Low Byte) from **6 to Fh**.

To **stop** the drive, set the control word (Low Byte) to **6**.

To control the drive via Terminal Block (TB3), the Control Word Low Byte must be set to 06h (state READY TO SWITCH ON).

Table 5.D

Status Word (Bit definition)

Bit No.	DRIVECOM 20 Status	SSC160
0	Ready to switch-on	1 = Ready
1	Switched-on	1 = Switched-on
2	Operation enabled	1 = Enabled
3	Fault	1 = Fault
4	Voltage-disabled	0 = Disabled
5	Fast stop	0 = Stop
6	Switch-on-disabled	1 = Disabled
7	reserved	
8	reserved	
9	Remote	0 = Local
10	Speed Ref. Reached	1 = Speed Ref. Reached *
11	Speed limited	1 = Speed limited *
12	reserved	
13	reserved	
14	Reverse Disabled	1 = Reverse Disabled
15	Direction	1 = Reverse (running)

* Internal speed reference/feedback is computed in 0.1Hz increments.

Due to rounding issues speeds in RPM may differ.

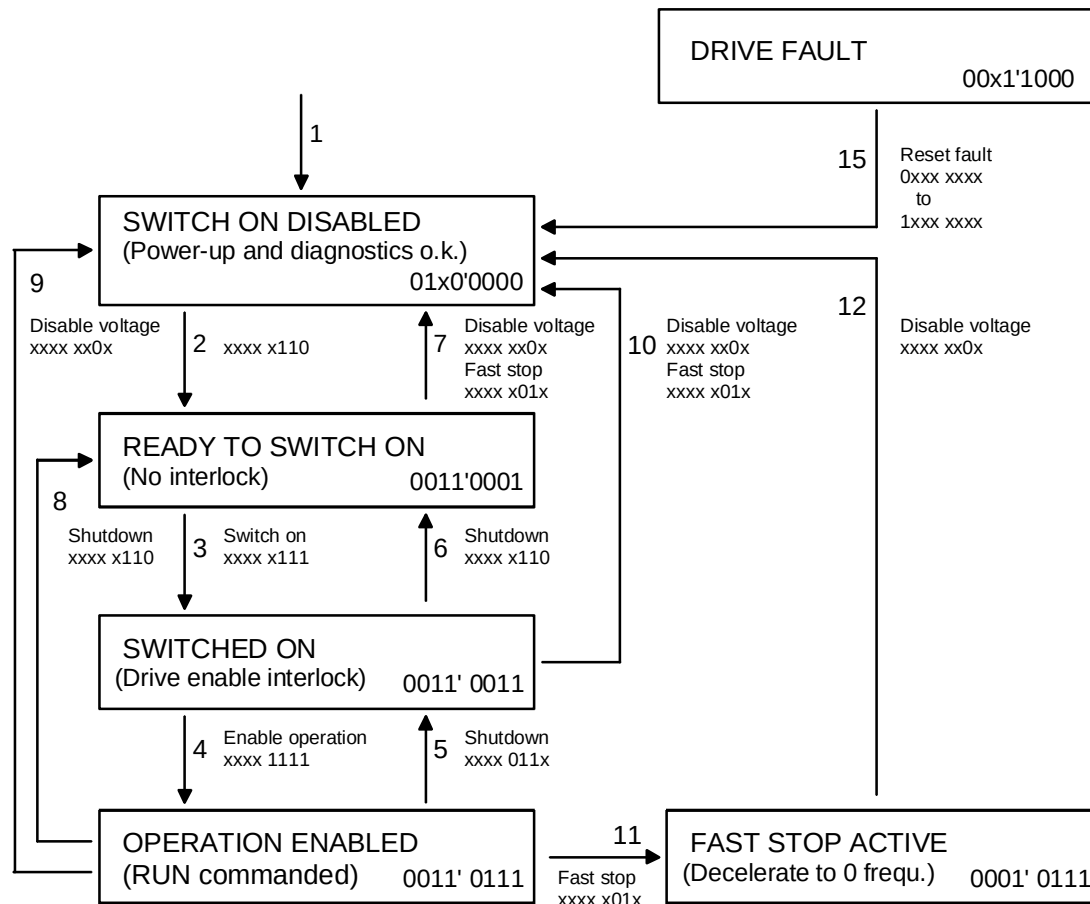
Resolution error in RPM = P66 * 0.05.

Example: for P66 = 16.6 the possible error is 1 RPM.

Drive State Transitions

The following Figure 5.1 shows the most important state transitions

Figure 5.1
State Diagram



State Transition Names and Numbers with associated **Control Words** (Low Byte) appear outside the boxes
Drive State Names with associated **Status Words** (Low Byte) appear inside the boxes

State Transition Description

Transition Name	Triggered State Transition	Control Word Bit 7..... Bit 0	Description
Disable voltage (High priority stop)	7, 9, 10, 12	xxxx xx0x	Stop operation (current loop off) from any STATE and after FAST STOP ACTIVE.
Shutdown (Stop command)	2, 5, 6, 8	xxxx x110	Command to get to READY TO SWITCH ON after SWITCH ON DISABLED or fault reset. Command to stop the drive if it is running.
Switch on *	3	xxxx x111	Command to get (from READY TO SWITCH ON) to SWITCHED ON state can be replaced by Enable operation for running
Fast stop	7, 10, 11	xxxx x01x	Stop as fast as possible (with current)
Power-up successful *	1		Needs no command as it is done inside the module itself
Enable operation	4	xxxx 1111	Start the drive if previous states are SWITCHED ON or READY TO SWITCH ON.
Reset fault	15	0xxx xxxx to 1xxx xxxx	Comand to clear a present fault

* These transitions are not needed for operation.

Note: The state SWITCHED ON is like power on to the drive, but this is a virtual state because the power to the drive is applied all the time in our case.

Parameter Access

Parameter access is established by object indices and parameter related sub-indices to be sent via the PCP telegram.

Table 5.E

Parameter Type	Parameter Numbers	Index	Sub-Index (decimal)
Display	P01 – P20, P30 – P84	0x5FF0	1 to 99(1-20, 30-84) Read
Program	P30 – P84	0x5FF1	1 – 86 (84) Read Parameter Default
Program	P30 – P84	0x5FF2	1 – 86 (84) Read Parameter Low Limit
Program	P30 – P84	0x5FF3	1 – 86 (84) Read Parameter High Limit
Program	P30 – P84	0x5FF4	1 – 86 (84) Read Parameter Attribute
Program	P30 – P84	0x5FF9	30 – 86 (84) Write
Fault Code		0x603F	Active Fault according to Table 8B

Parameter attributes

Each parameter is described by an attribute to be read according to table 5.F. The attribute consists of one word with 2 bytes which are defined as follows:

High Byte stores the Unit (scaling) according to the table 5.G,

Low Byte stores the parameter number.

Table 5.F

High Byte	Units
0	Decimal 1
1	Decimal 0.1
2	Decimal 0.01
3	Hexadecimal 1
4	Binary 1
5	Decimal (signed) 1
6	Decimal (signed) 0.1
7	Decimal (signed) 0.01

Parameter Access Fault Codes

("Additional Error Codes")

The error messages listed in the table 5.G indicated problems when attempting to access parameters via PCP.

The drive will NOT fault but indicate to the user that a specific parameter access failed.

Table 5.G

Error Code	Error
1	Parameter size is too small (e.g. byte instead of word)
4	Parameter value is out of limits
10	Parameter write attempt while drive is running
11	Parameter number too small
12	Parameter size is too large (e.g. 3 bytes instead of two bytes)
20	Parameter number not valid
22	Parameter number is too high
30	No valid response from drive

Communication Statistics

The following communication statistics can be read via the InterBus Register 3 from the Network option.

Table 5.H

Write		Read
Decimal	Hex	Statistics
0	0	Background task counter
14	E	Total PCP messages received
15	F	Total PCP message errors received
16	10	Total PCP messages sent
17	11	Total PCP message errors sent
18	12	Total PCP protocol aborts
Others		Diagnostics

Using the 160-IB1 on InterBus

The purpose of this chapter is to provide an example of the steps necessary to use the 160-IB1 on an InterBus network. As InterBus is a 3rd party network, we will be using an SST-IBS-SLC scanner to act as a master for InterBus, residing in an A-B SLC500 rack.

The SST scanner sends I/O messages periodically to a Bulletin 160-IB1 to start and stop the drive and control its speed. Additionally the Bulletin 160-IB1 responds to these I/O messages by sending status messages and speed feedback back to the scanner. In this way the ladder logic program in the A-B SLC500 PLC can control the drive.

The Bulletin 160-IB1 also supports an InterBus telegram which can be used to configure or read parameters from the drive.

This chapter contains the following information:

- How to create an InterBus network configuration frame.
- A sample ladder logic program to control the Bulletin 160 SSC using I/O messaging
- A description of the InterBus PCP telegram.
- A sample ladder logic program to execute the PCP telegram

The SST-IBS-SLC scanner for the SLC500 is used in the examples in this manual. However the concepts demonstrated in the examples apply to any InterBus master.

Required Tools

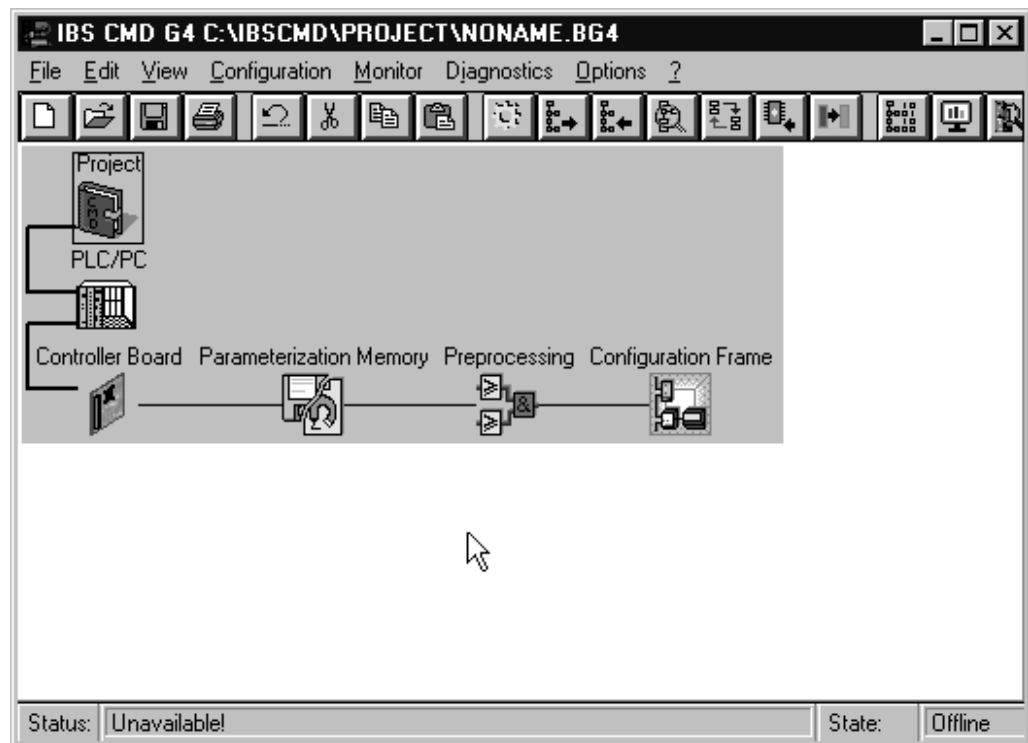
The following tools are needed to complete this chapter.

- Bulletin 160 series C equipped with a 160-IB1 InterBus communication module
- SLC500 processor with a digital input card to issue start & stop commands
- Phoenix IBS CMD SWT G4 software to configure the scanner and a null modem RS232 serial cable.

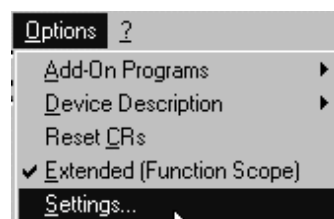
Create an InterBus Network Configuration Frame

This example assumes that the SLC 500 rack has been configured correctly with the SST-IBS-SLC card in slot 3. If configuration is required an example of configuration is shown further in this chapter – The InterBus PCP Telegram. Additionally it is assumed that a 160 drive with an 160-IB1 interface is connected on the InterBus remote bus with a relevant 9 way D shell connector (see chapter 3).

Invoke Phoenix IBS CMD software and create a new project with "File Menu" and "New".



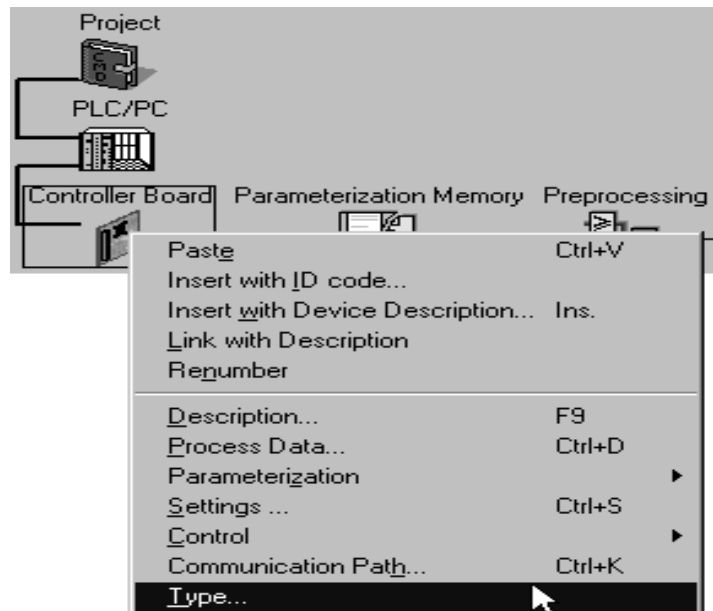
Go to extended mode,.



then to the "Settings" mode. On the "Settings" dialogue box select the Drivers tab and select the "communication path" button.

In this example, the connection to the SST scanner is via a null modem cable from the serial port on COM1 at 9600 baud. Adjust the path accordingly and click OK twice.

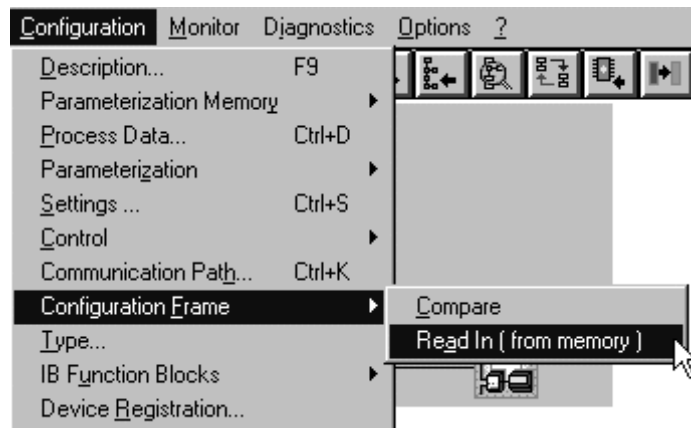
Click (select) the controller board and right mouse click "type" to select the type of scanner.



Click IBS USC(4K) as the controller type and click ok.

With the "controller board" selected, hit F3 on your PC (the state button). Select Configuration (on-line) and click ok. If the processor is faulted, you will not be able to go on-line. So put the processor into program mode with the keyswitch., then select Configuration (on-line).

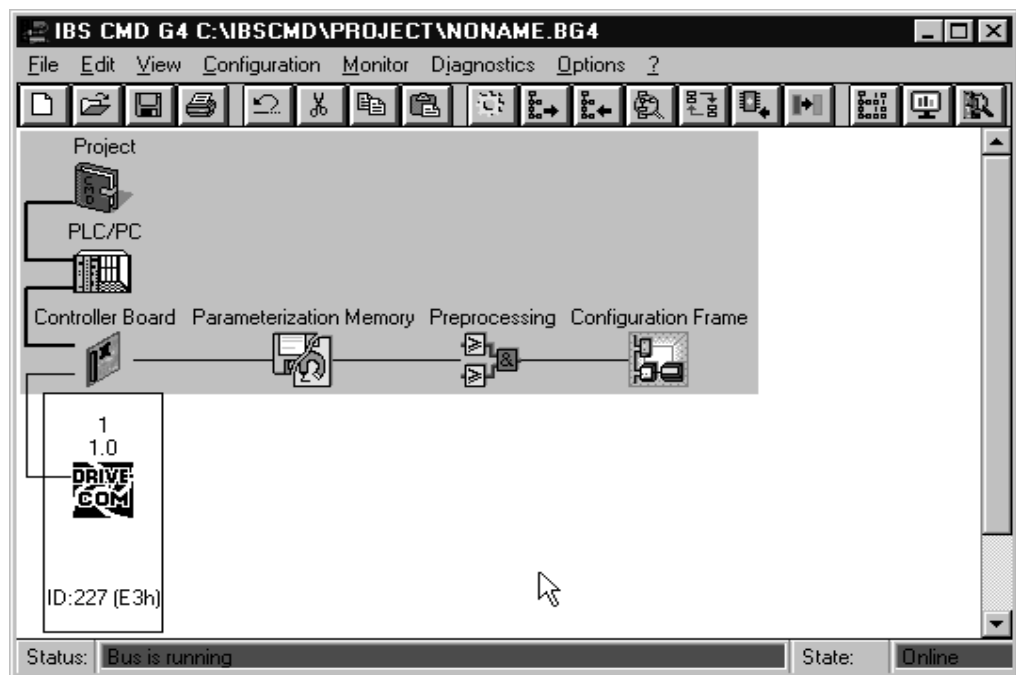
Now select "configuration" and "configuration frame" and "read in" the network that is attached to the scanner.



You will probably get the message that the parameterisation of the controller board will be lost. This is ok because it was not valid anyway. Select Yes.

Also you may get the message that the software is unable to read the parameter channel settings. Select OK to continue.

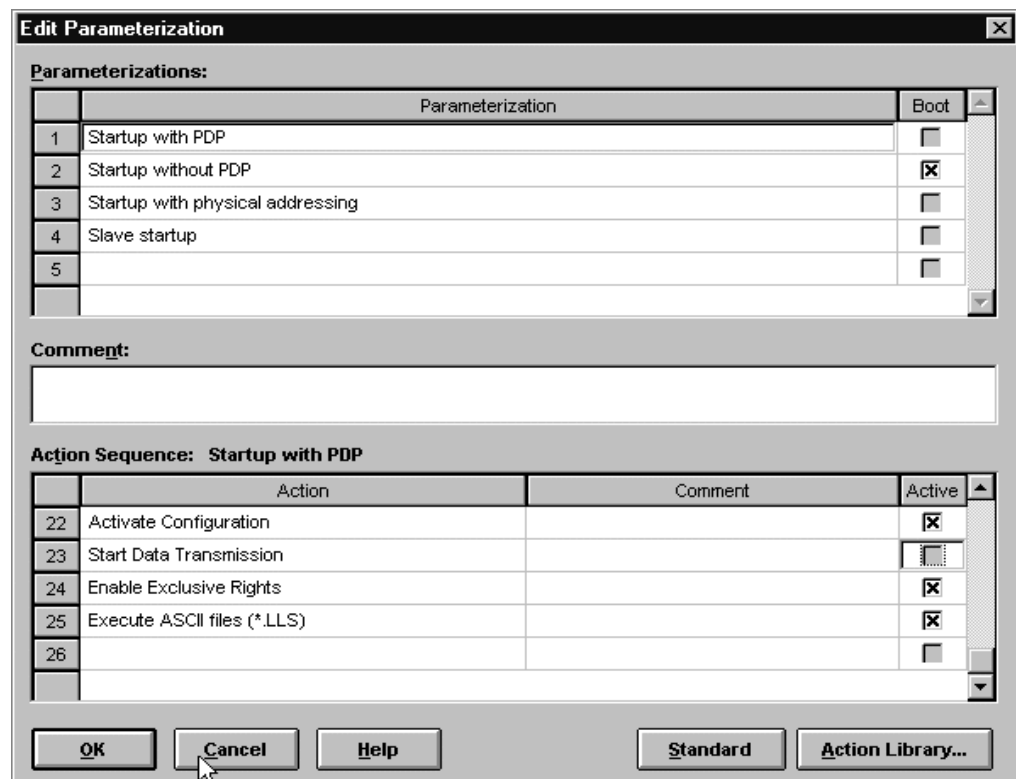
In this case you see one module has been identified as a DRIVECOM assembly with InterBus library identifier 227.



Look at the LED's on the 160-IB1 module, BA is flashing, indicating that the module is not being controlled by anything.

Now with the controller still selected, right click and choose "Parameterization" and "Edit" to specify how we want the scanner to start up.

Select "Startup without PDP" and uncheck "start data transmission" (action 23) and click ok.



Now save the file with a filename. Choose "File" and "Save" commands.

The network should now be configured with the 160-IB1 BA LED now steady green. If not, check that the processor is in Run mode. InterBus assigns a communication reference (CR) dynamically when the network(frame) is read in. It starts with the first module it sees on the network, assigns a CR=2 and specifies memory allocation for the I/O messaging. Then the CR and memory allocation increments for each module it sees. Therefore any new nodes added to a network should ALWAYS be added to the end of the network.

In order to view the memory allocation, select "Monitor" and "Controller Board" and "Address Monitor".

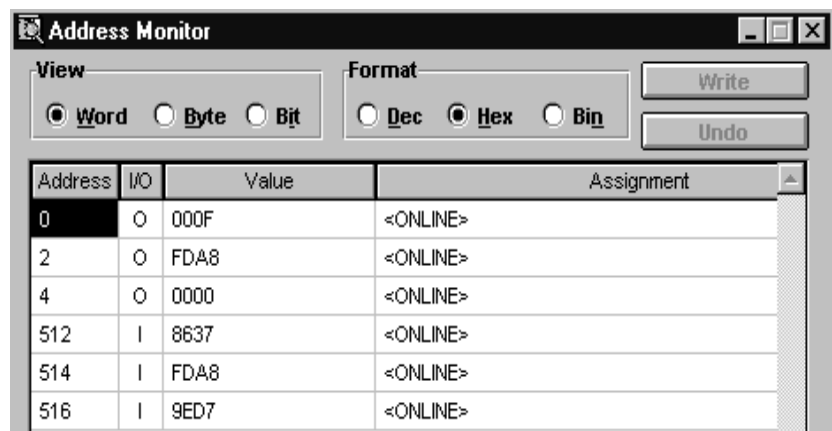
The 160-IB1 with the DRIVECOM 20/21 implementation is mapped 3 words input and 3 words output, mapped to the start of the memory of the scanner card. In this case as the IBS scanner is in slot 3 of the SLC rack, then address 0 is the first output address of the card i.e. O:3.0.

Outputs

Address 0	Command word
Address 1	Speed reference
Address 2	Diagnostics

Address 512 (Inputs) are the first input addresses of the scanner card:
I:3.0

Address 0	Status word
Address 1	Speed feedback
Address 2	Diagnostics.



The screenshot shows the 'Address Monitor' window with a table of memory addresses. The table has four columns: Address, I/O, Value, and Assignment. The data is as follows:

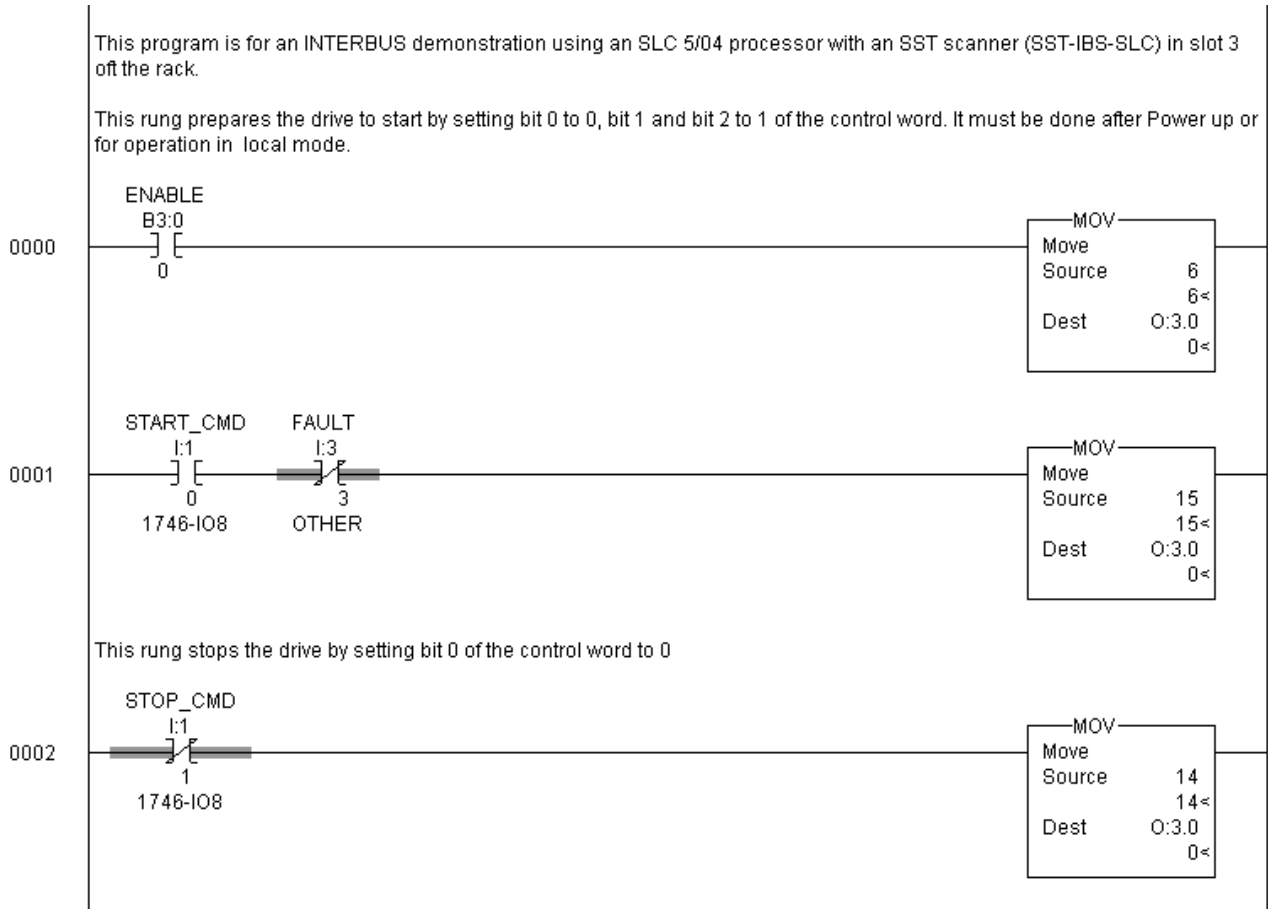
Address	I/O	Value	Assignment
0	O	000F	<ONLINE>
2	O	FDA8	<ONLINE>
4	O	0000	<ONLINE>
512	I	8637	<ONLINE>
514	I	FDA8	<ONLINE>
516	I	9ED7	<ONLINE>

The window also includes a 'View' section with radio buttons for Word (selected), Byte, and Bit. A 'Format' section has radio buttons for Dec, Hex (selected), and Bin. There are 'Write' and 'Undo' buttons on the right.

Controlling the Drive with I/O Messaging

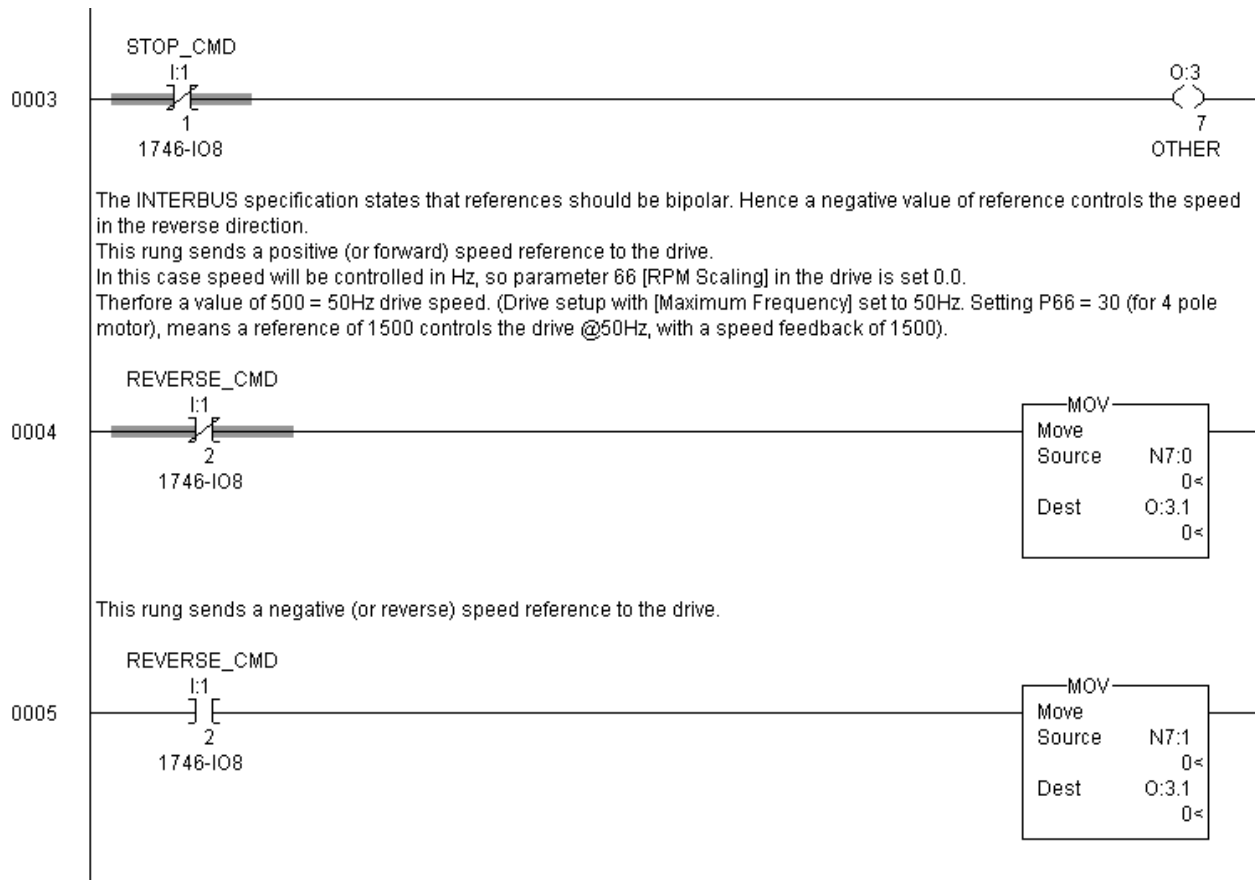
Now adjust the drive parameters as defined in chapter 5 of this manual in order to test the drive with the following program example:

Figure 6.1
Drive Test Program Ladder Logic Example.



Ladder diagram continued on next page

Drive Test Program Ladder Logic Example (continued)



The InterBus PCP Telegram

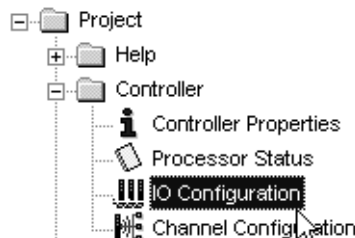
The Peripherals Communication Protocol (PCP) of InterBus supports 2 different types of independent data transmission.

The 3 words that were mapped previously in this chapter, is the process data channel which is the cyclic transmitted I/O data to start/stop the drive and provide reference and feedback. The parameter data channel is much slower, working around the process data channel, to read/write parameters to the drive.

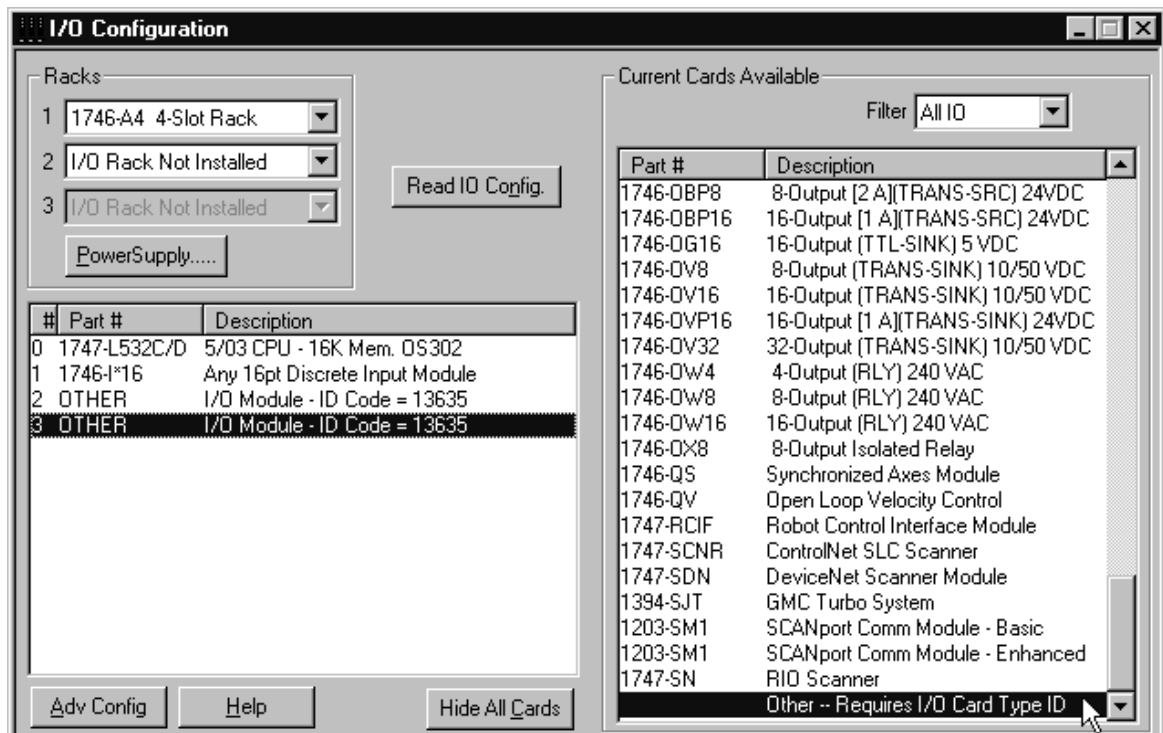
The parameter data channel is handled by the InterBus master and transmits a frame of information only when required.

This form of messaging is performed by copying data to and from the SST-IBS-SLC card M0 and M1 files. Therefore the SST-IBS-SLC card needs to be setup to support the PCP telegram.

If starting from scratch create a new project using RSLogix500 software and select the I/O Configuration to specify the processor, Digital Input card and SST-IBS-SLC. If you are using an existing configuration you will need to modify to suit.

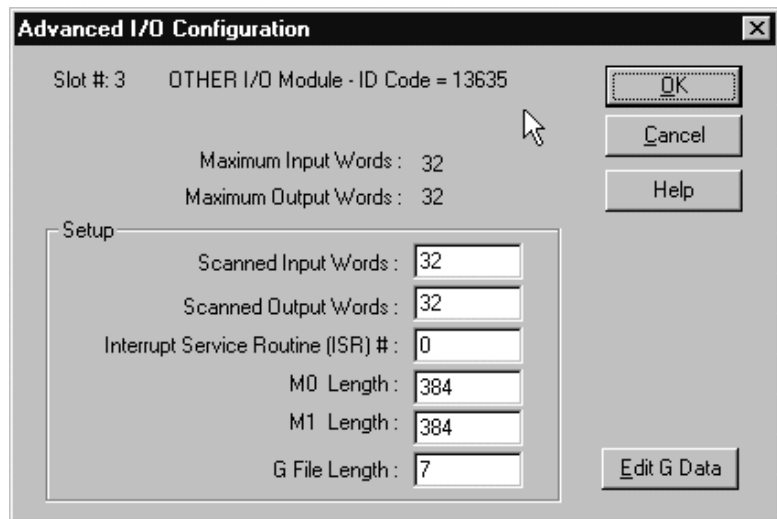


Note that the example configuration below has an additional SST card in slot 2. This is not used in the following example.



The Scanner is configured for the rack with generic ID = 13635.

Select the Advanced Config button, to setup the card as shown. This means that there are 32 words reserved for process data (I/O) and the M files are set to 384 words. To make PCP function we need to setup the G files with data. So the G files length = 7.



Select the Edit G file data button, to setup the data for the InterBus telegram. (see SST-IBS-SLC user manual for details)

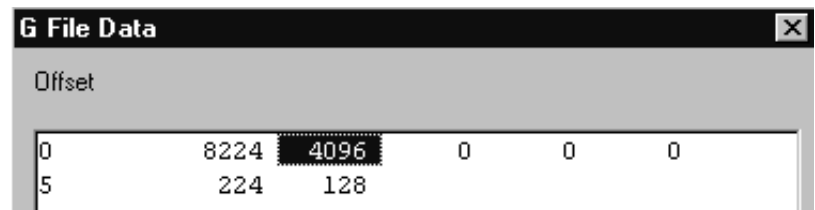
Word 0 is fixed by the SLC

Word 1 bit 12=1 (4096)

Word 5 defines where M files stop for I/O and where M files start for PCP (225)

Word 6 Command buffer size for PCP

These values are just an example of setup and the SST-IBS-SLC user manual should be consulted to optimise the PCP setup.



Download this I/O configuration to the SLC. The card is now setup to communicate with the InterBus telegram.

How it works

The number of words to be setup in the M files, varies as the type of message to be transmitted. In the sample program following, the M files are being copied to integer files so we can easily send/receive data.

N7:70 is M0:3.225 onwards – the output data to the drive

N7:80 is M1:3.225 onwards – the input data from the drive

This is an example of a read drive parameter (all values in hex)

```

N7:70      2 5FF0 8 0 0 0 0 0 0 0
N7:80      4 4 2 0 2 45 0 0 0 0

```

The first node on the network is a communication reference (CR) = 2, with the parameter read access index of 5FF0 (see table 5E) and the sub-index specifying parameter 8 [Heatsink Temperature].

Once transmitted, the response in

N7:80 provides an echo of the command word

N7:81 number of words following

N7:82 CR

N7:83 result of comms 0=success

N7:84 number of bytes read (in this case 1 word)

N7:85 data read 45 hex = 69 decimal which is the normal value registered on the heatsink, when temperature is below it.

This is an example of a read attribute drive parameter (all values in hex)

```

N7:70      2 5FF4 1E 0 0 0 0 0 0 0
N7:80      4 4 2 0 2 11E 0 0 0 0

```

The first node on the network is a communication reference (CR) = 2, with the parameter read attribute access index of 5FF4 (see table 5E), and the sub-index specifying parameter 30 [Accel Time 1].

Once transmitted, the response is similar to above:

N7:85 LSB of 1E is parameter 30, MSB of 1 is multiplier (see table 5F).

This is an example of a write attribute drive parameter (all values in hex)

```

N7:70      2 5FF9 1E 2 50 0 0 0 0 0
N7:80      8 2 2 0 2 11E 0 0 0 0

```

In this example the write access index is 5FF9 (see table 5E) and the sub-index specifying parameter 30 [Accel Time 1].

N7:73 specifies the number of bytes to write

N7:74 is the data to write

N7:80 provides an echo of the command word

N7:81 number of words following

N7:82 CR

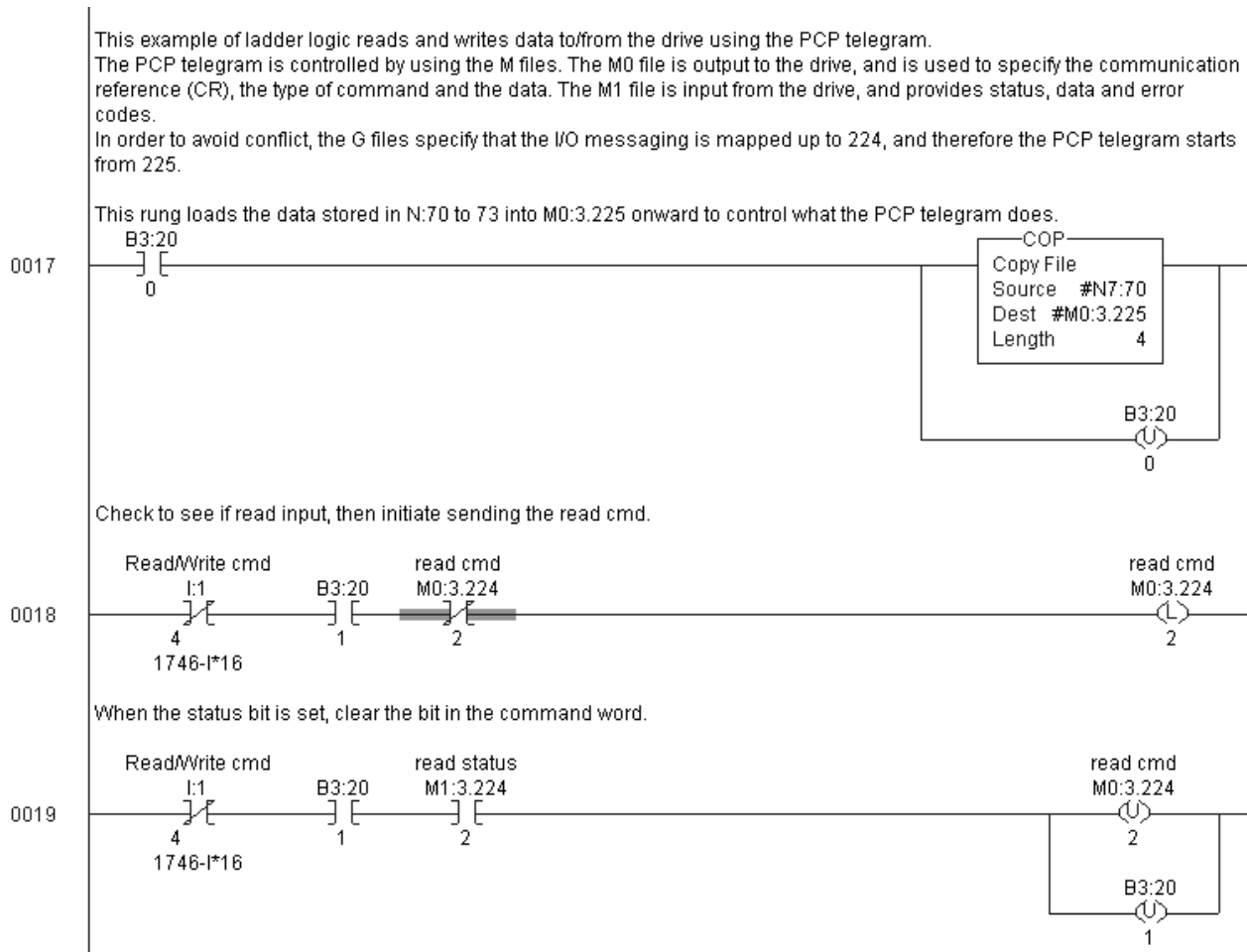
N7:83 result of comms 0=success

N7:84 & N7:85 are not valid, being values that were updated on the read attribute exercise.

Reading and Configuring Parameters with the PCP Telegram

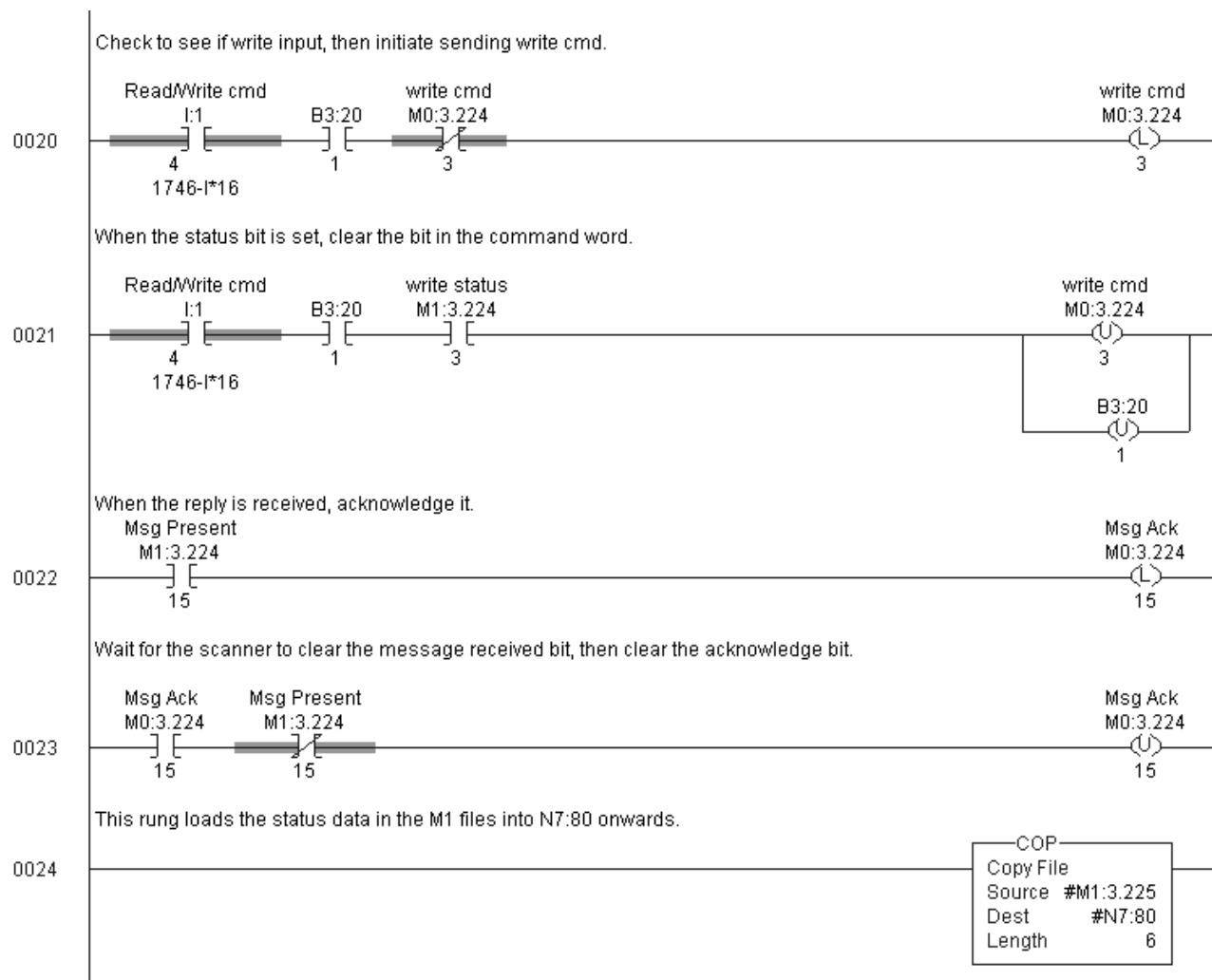
Figure 6.2
PCP Telegram Ladder Logic Example

This program example can be made to operate by first setting I:1.4 to request a read or write operation, the setting B3:20 bit 0 to 1 to update the data in N7:70 onwards into the M0 files, then setting B3:20 bit 1 to 1 to send the data.



Ladder diagram continued on next page

PCP Telegram Ladder Logic Example (continued)



Controlling the Drive

Controlling the 160 Drive from a programmable controller is accomplished using Message Commands to communicate through the IB1 Module to the drive. To send a Start or Stop command to the drive, the corresponding control bits in the DRIVECOM Control Word must be set.

Setting the Drive to Enable Network Control

The 160 Drive must be configured to accept logic and speed commands from the network. This is done by configuring three parameters:

1. Set **P46 - [Input Mode]** to a value of “2” or “6” as described in the following Table. This will configure the drive to accept the logic commands from the network.

Important: The drive may be operated in other modes as long as the InterBus Master provides an Enable command (control word = **0x6**)

2. Set **P59 - [Frequency Select]** to “1.” This will configure the drive to accept speed commands from the network.
3. Set **P66 - [RPM Scaling]** according to rated nameplate speed. (See chapter 5 for details).

Changing the above parameters can be done with the 160 Keypad Module or configuration software such as DriveExplorer.

Important: For a new Input Mode to take affect, drive power must be cycled or parameter **P56 - [Reset Functions]** must be set to “2” instead.

End of Chapter 7

Troubleshooting

The purpose of this chapter is to help you troubleshoot your IB1 Module.



ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NPFA 70E, *Electrical Safety for Employee Workplaces*, when working on or near energized equipment. Do not work alone on energized equipment.



ATTENTION: Do not attempt to defeat or override fault circuits. The cause of a fault indication must be determined and corrected before attempting operation. Failure to correct a drive or system malfunction may result in personal injury and/or equipment damage due to uncontrolled machine system operation.

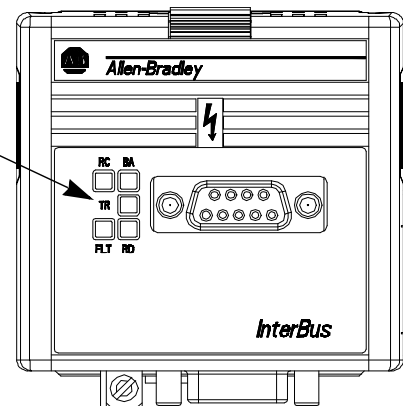
Setup

Make sure parameters **P46**, **P59** and **P66** have been set according to chapter 5.

LED Indicators and Troubleshooting

The IB1 Status LEDs can help you troubleshoot the module in the event that problems occur. Refer to the paragraphs that follow for details.

Status LEDs
Refer to Chapter 4 for
detailed LED descriptions



Communication Status LEDs

In case no LED is on, check the options connected to the SSC160.

The four Communication Status LEDs provide status information on module operations. Table 8.A shows how to use the LED to detect and correct common operating problems.

Table 8.A
Communication Status LEDs Indications

Name (Function)	State	What It Means:	What To Do:
RC (Remote Bus Check)	Off	No power, processor reset, InterBus reset or network link to predecessor in line interrupted	Check Power Supply, Network Cable and InterBus Master operation.
	yellow	Input cable connection o.k.	No action required.
BA (Bus Active)	Off	Bus inactive	Check InterBus Master setup.
	green	Bus Active / Data exchange	No action required.
TR (Transmit/ Receive)	Off	No PCP Communication	If PCP operation is desired, check IB Master setup (initiate PCP).
	green	PCP Communication active	No action required.
RD (Remote Bus Disable)	Off	Outgoing InterBus enabled	No action required.
	red	InterBus Reset or outgoing Bus disable	No action required on last device in line (empty top plug). Otherwise check cabling and reset Master.

FLT LED

When the FLT LED is red, a drive fault is present.

Table 8.B
InterBus Faults (DRIVECOM 20) in Object 603F

Fault No. [Hex]	Fault Name	Fault Code SSC160 [Dec]
0	no fault	0
1000	General Malfunction	nn
2200	Internal Current	13
2300	Current on Device Output Side	12
2320	Current on Device Output Side: Short Circuit/ Earth Leakage	46
2331	Current on Device Output Side: Earth Leakage Phase U	38
2332	Current on Device Output Side: Earth Leakage Phase V	39
2333	Current on Device Output Side: Earth Leakage Phase W	40
2341	Current on Device Output Side: Short Circuit Phases U-V	41
2342	Current on Device Output Side: Short Circuit Phases V-W	42
2343	Current on Device Output Side: Short Circuit Phases W-U	43
3210	Internal Over Voltage	5
3221	Internal Under Voltage No. 1	3
3222	Internal Under Voltage No. 2	4
4210	Excess Temperature Device	8
4310	Excess Temperature Drive	20
5000	Model of drive not valid	
5300	Device Hardware: Operating Unit	11
5310	Device Hardware: Data Storage RAM	
5320	Device Hardware: Data Storage EPROM	
6100	Device: Internal Software	32
6200	Device: User Software	33
6320	Device Software/ Data Record: Parameter Error	48
7500	IBS fatal protocol error	

Fault No. [Hex]	Fault Name	Fault Code SSC160 [Dec]
7510	Serial interface to drive timeout	
7520	Serial interface IBS bus not active	
8100	Monitoring: Communication	36
8311	Monitoring/ Torque Control: Excess Torque	7
8313	Monitoring/ Torque Control: Standstill Torque	6

Drive faults can be read via index 0x603F. Refer to Table 8.C Table 8.D for fault number relation.

Drive fault codes can be read by accessing drive parameter **P07 - [Last Fault]**. Refer to Table 8.C and Table 8.D for fault descriptions/actions.

Table 8.C
160 Drive¹ Fault Codes

Fault Code	Fault Indication	Description	Corrective Action
00	No Fault	The drive is currently not faulted.	No action required.
03	Power Loss Fault	DC Bus voltage remains below 85% nominal on power up for longer than 5 seconds.	Monitor incoming AC line for low voltage or line power interruption.
04	Undervoltage Fault	DC Bus voltage fell below the minimum value while the motor was running.	Monitor incoming AC line for low voltage or line power interruption.
05	Overvoltage Fault	DC Bus maximum voltage exceeded.	Bus overvoltage caused by motor regeneration. Extend the decel time, or install dynamic brake option or external capacitor module.
06	Motor Stall Fault	Motor has stalled. Motor load is excessive.	Longer accel time or reduced load required.
07	Motor Overload Fault	Internal electronic overload trip. Excessive motor load exists.	Reduce motor load.
08	Overtemperature Fault	Excessive heat detected.	Clear blocked or dirty heat sink fins. Check ambient temperature. Check for blocked or non-operating fan.
11	Operator Fault	The keypad has been removed while the drive is powered.	Clear the fault. Do not remove the keypad underpower.
12	Overcurrent Fault	Overcurrent detected in hardware trip circuit.	Check short circuit at the drive output or excessive load conditions at the motor.
13	Software Over Current Fault	Motor current exceeded value set in parameter 79.	A longer acceleration time, reduced load, or removal of motor shaft blockage is required.
20	Drive Overload Fault	An internal electronic overload trip has occurred. The drive is overheating.	Clear blocked or dirty heat sink fins. Check ambient temperature. Check for blocked or non-operating fan.
22	Drive Reset	Stop input not present.	Check stop input at TB3 terminal 8.
32	EPROM Fault	EPROM has invalid data.	Reset EPROM using P56 - [Reset Functions] .
33	Max Retries Fault	Drive did not reset fault within the specified retries.	Repair system fault.
36	Incompatible Fault	Incompatible communication module installed.	Verify compatibility of communication module.
38	Phase U Fault	Phase to ground fault detected between drive and motor phase U.	Check wiring between drive and motor. Check motor for grounded phase.
39	Phase V Fault	Phase to ground fault detected between drive and motor phase V.	Check wiring between drive and motor. Check motor for grounded phase.
40	Phase W Fault	Phase to ground fault detected between drive and motor phase W.	Check wiring between drive and motor. Check motor for grounded phase.
41	UV Short Fault	Excessive current has been detected between these two drive output terminals.	Check the motor and external wiring to the drive output terminals for a shorted condition.
42	UW Short Fault	Excessive current has been detected between these two drive output terminals.	Check the motor and external wiring to the drive output terminals for a shorted condition.
43	VW Short Fault	Excessive current has been detected between these two drive output terminals.	Check the motor and external wiring to the drive output terminals for a shorted condition.
46	Intermittent Phase Fault	An external short occurred while running diagnostics.	Check wiring between the drive and the motor. Check for more than one shorted output.
48	Reprogramming Fault	Occurs when reset defaults is performed.	Clear fault.

¹ Refer to the 160 SSC™ V S D (Series C) *User Manual* for the most current fault code information.

IB1 Network Error Codes

The following error codes could be returned when accessing the IB1 Module.

Table 8.D
Network Fault Codes

Fault Code	Fault Indication	Description	Corrective Action
7510	Serial Fault	No serial Connection established	Check if SSC160 of version 'C' or higher has been installed. (Refer to drives nameplate). Check 30 pin connector on the options back. Check Parameter setting according to Section 6.
7520	Unit lost Connection	Timeout on serial link	Check units plugs to SSC160 and IBS cable.
7500	Unit unrecoverable Fault	Unexpected Network Fault	restart IBS master or drive
5000	Model of Drive not valid	Use 160 Drive with version 'C' or higher	Replace Drive

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